3) Darlington Pair (analysis). Assume two 6144 NPN transistors are connected as a Darlington pair.

- | Vbe | = 0.7V
- | Vce | = 0.36V when saturated
- $\beta = 200$

Let Rb be 1000 + 100(Birth Month) + Birth Day. (Mine = 1514 Ohms). Find the currents and voltages.

Rb 1000 + 100*Mo + Day	I1	I2	I3
1514 Ohms	2.378mA	5.574mA	1.115A
	V1	V2	V3
	1.4V	0.7V	1.06V

Transistor T1 is saturated

Transistor T2 is active (I3 = 200 I2)

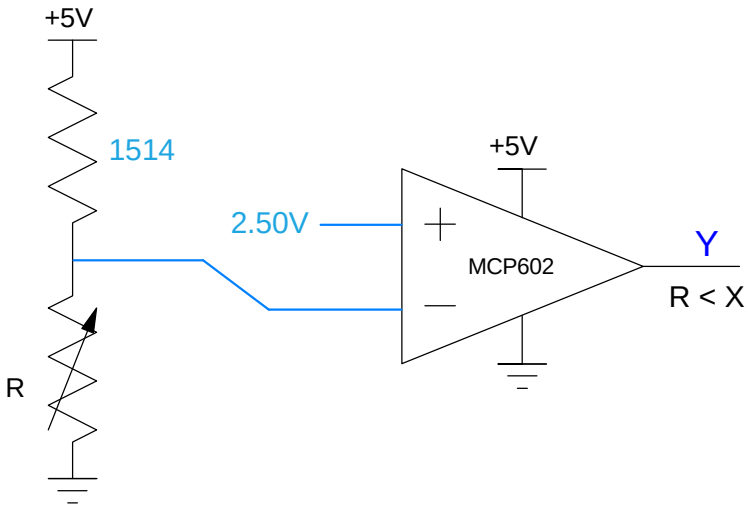
$$I_1 = \frac{5-1.4}{1514} = 2.378mA$$

$$I_5 = I_3 + I_4 = \frac{10V-1.06V}{8\Omega} = 1.118A$$

4) Comparitor: Design a circuit which output

- 0V when R > X Ohms
- 5V when R < X Ohms

where X is 1000 + 10*(Birth Month) + (Birth Day).



5) Schmitt Trigger: Design a circuit which output

- 5V when R < X Ohms
- 0V when R > X + 200 Ohms
- No change for X < R < X + 200 Ohms

Let X be 1000 + 10(Birth Month) + (Birth Date).

X = 1514 Ohms

R = 1514 Ohms

- V1 = 2.500V
- Y = 5V

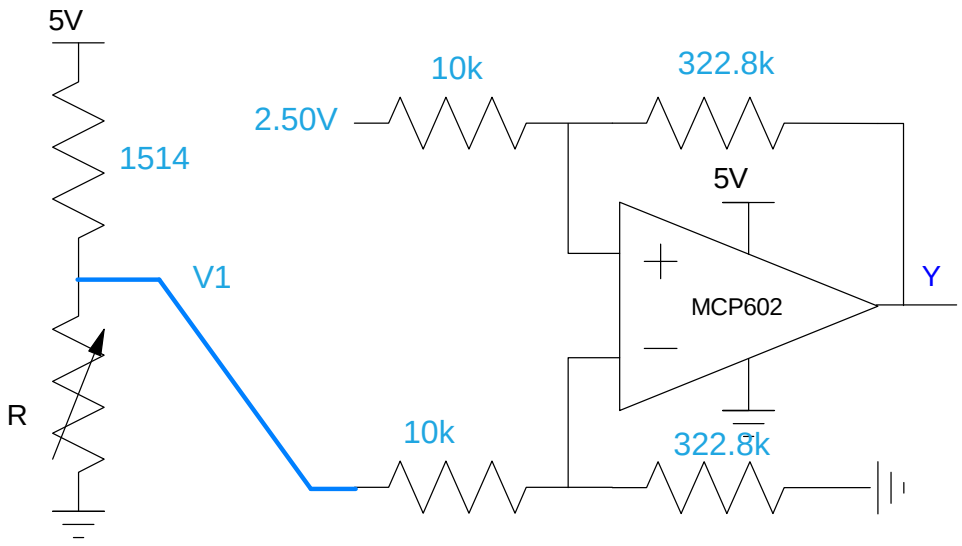
R = 1714 Ohms

- V1 = 2.655V
- Y = 0V

Connect to the minus input (Y goes down when V1 goes up)

Make the offset 2.500V (Y goes high when V1 is 2.5V)

Make the gain $\frac{5V-0V}{2.655V-2.500V} = 32.38$



6) Schmitt Trigger: Analysis. Determine the voltage and resistance where the following Schmitt trigger turns on and off. Assume Rx is 1000 + 100*(Birth Month) + (Birth Day). May 14th gives Rx = 1514 Ohms.

Rx 1000 + 100*Mo + Day	On (V2 = +5V)		Off (V2 = 0V)	
1514	V1	R	V1	R
	3.50V	3533	1.833V	876

$$gain = 3.00 = \frac{5V - 0V}{V_{on} - V_{off}}$$

$$V_{off} = 3.50V - \frac{5V}{3} = 1.833V$$

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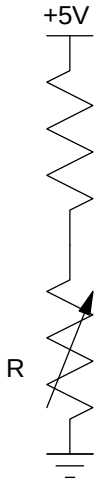
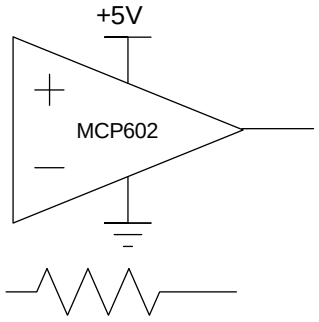
$$R_{on} = \frac{3.5V}{5.0V - 3.5V}\ 1514 = 3533\Omega$$

$$R_{off} = \frac{1.833V}{5V - 1.833V}\ 1514 = 876\Omega$$